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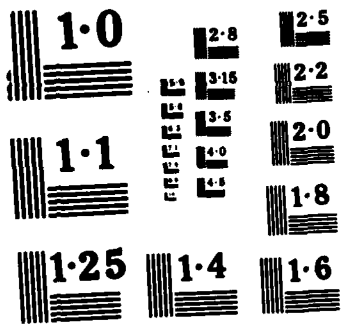

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CHANGES IN FITNESS AND SHIPBOARD TASK PERFORMANCE FOLLOWING CIRCUIT WEIGHT TRAINING PROGRAMS FEATURING CONTINUOUS OR INTERVAL RUNNING

E. J. MARCINIK
J. A. HODGDON
C. E. ENGLUND
J. J. O'BRIEN

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NAVAL HEALTH RESEARCH CENTER
P.O. BOX 85122
SAN DIEGO, CALIFORNIA 92138-9174

NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
BETHESDA, MARYLAND

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FOLLOWING CIRCUIT WEIGHT TRAINING PROGRAMS

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E. J. Marcinik

J. A. Hodgdon

C. E. Englund

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Naval Health Research Center

P.O. Box 85122

San Diego, California 92138-9174

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SUMMARY

Physiological data was collected on 57 Navy men ($\bar{x}$ age = 19.5 yrs) prior to and following participation in either circuit weight training/continuous run (CWT/CR) (N = 31) or circuit weight training/interval run (CWT/IR) (N = 26) programs. Measured variables included 4 measures of upper torso dynamic strength (one repetition maximum [1RM] for arm curl, bench press, shoulder press, and lat-pulldown); two measures of lower torso dynamic strength (one repetition maximum [1RM] for knee extension and leg press); one measure of power (number of revolutions completed on a Monark arm ergometer at maximum drag); three measures of muscular endurance (number of repetitions at 60% 1RM for bench press and leg press and maximum number of bent-knee sit-ups in 120 s); one stamina measure (time to exhaustion on a bicycle ergometer maximal work capacity [MWC] test; and 3 simulated shipboard tasks: manikin shoulder drag, open/secure a water tight door and paint bucket carry. Composite shipboard performance derived from the summed time (s) required to complete the three tasks was also calculated. Results show performance on the manikin shoulder drag and majority of evaluative fitness measures was significantly ($p \leq 0.05$) enhanced following both circuit weight training/run formats. Significantly ($p \leq 0.05$) higher values for shoulder press ($F = 7.2$), arm ergometer ($F = 5.3$), and sit-ups ($F = 6.8$) and lower values for leg press muscular endurance ($F = 5.1$) were observed in CWT/IR when compared to CWT/CR. Regression analysis yielded the following prediction equation: Composite shipboard performance (s) = 194.15097 - 1.59492 (arm curl) - .18369 (leg press) $r = 0.74$

It can be concluded that participation in these varied exercise regimens was associated with differential changes in fitness but not shipboard work performance. Furthermore, the association between training induced fitenss gains and relative improvment in job performance appears to be specific to the task modelled. Important predictors of criterion task performance included measures of both upper torso and lower torso muscular strength.

INTRODUCTION

The most physically demanding Navy shipboard jobs have been characterized as involving lifting, carrying, and pulling efforts (Robertson, 1983). Robertson contends that such muscular efforts demand predominantly upper torso strength. The human factors literature (U.S. Department of Health and Human Services, 1981) however clearly cites the significant contribution of back and leg musculature during manual lifting tasks. Furthermore, empirical evidence suggests that muscular endurance may influence carrying and pulling tasks when performed repeatedly during Navy shipboard evolutions.

Theoretically, an improved level of fitness should lead to improved performance of such tasks. While there is little doubt that circuit weight training improves strength, (Wilmore, et. al. 1978, Gettman, et. al. 1978), the extent that strength gains accrued from circuit weight training are translated into improved work performance is not known. Also while running in general enhances endurance performance, the training literature suggests the choice of interval or continuous running styles depends on the specific event for which you are preparing (Wilmore, 1973).

Finally, it is unclear to what relative extent upper and lower torso musculature are involved in shipboard undertakings. This investigation therefore, took on a twofold purpose: 1) to compare fitness and work performance changes following participation in circuit weight training regimens featuring either interval or continuous running programs, and 2) to validate a battery of upper and lower torso muscular strength and endurance measures against performance of several generic job tasks. Identification of valid predictive measures of shipboard work, may serve to enhance the Navy's future selection, classification and physical training processes.

MATERIALS AND METHODS

Participants were 57 Navy men aged 17 - 33 years (mean = 19.5 yrs.) receiving 8-week basic training at the Recruit Training Command, San Diego, CA. All subjects were briefed on the nature of the study and inherent risks. Each individual filled out an informed consent and privacy act document prior to participation. Physical characteristics of the recruit cohort are presented in Table 1.

Table 1
Participant Characteristics

	Mean	± S.D.
Age (yrs)	19.5	2.6
Height (cm)	176.1	6.2
Weight (kg)	73.6	11.6
% Body Fat	15.1	3.1

Procedures: Subjects were randomly assigned to either continuous run (N = 31) or interval run (N = 26) CWT programs. All subjects completed a total of three CWT and three running sessions per week, performed on alternate days. During each CWT session, subjects completed two circuits (1 circuit = 15 exercises) on a Universal® gym working at 60% of determined one repetition maximum (1RM) strength. Subjects rotated from station-to-station on a multi-station gym following a cycle of 15 s of work at a station with 15 s to move to the next station. Specific exercises included the bench press, hip flexor, shoulder press, knee extension, pull-up, arm curl, lat-pulldown, leg press, arm dips, inclined sit-ups, push-ups, body builders, flutter kicks, jumping jacks and handgrip. The 1RM for the weight exercises was re-evaluated after four weeks of training to adjust for strength changes. The continuous run format progressed from an initial 2.4 km run to a 3.6 km run performed at an 5.0 min/km^{-1} pace. CWT/IR subjects completed an identical CWT program but engaged in inverval runs progressing from 6 (.4 km) runs to 9 (.4 km) runs at a 4.4 min/km^{-1} pace with 15 seconds allowed between runs. A general outline of the exercise protocols for the groups is summarized as follows:

Mode	• Circuit Weight Training (CWT)*
Frequency	• 3 sessions/week (M, W, F)
Intensity	• 60% 1RM
Duration	• 2 circuits/session
Work/Rest	• 15 s work/15 s rest cycle

Mode	• Continuous Run (CR)
Frequency	• 3 sessions/week (T, Th, Sat)
Intensity	• 5 min/km^{-1}
Duration	• week 1-2 2.4 km
	week 3-4 2.8 km
	week 5-6 3.2 km
	week 7-8 3.6 km

Mode	•	Interval Run (IR)
Frequency	•	3 sessions/week (T, Th, S)
Intensity	•	4.4 min/km^{-1}
Duration	•	week 1-2 6X(.4 km)
		week 3-4 7X(.4 km)
		week 5-6 8X(.4 km)
		week 7-8 9X(.4 km)

*Performed by both training groups

Performance Assessment: To assess training program effectiveness, participants received a comprehensive performance evaluation at the initial and final stages of the training period. This assessment consisted of a series of tests to measure muscular strength, power, muscular endurance, stamina, relative body composition and shipboard task performance.

Muscular Strength: Muscular strength (the maximal force which a muscle or set of muscles can generate) was determined utilizing dynamic strength measures. Dynamic strength was measured as the 1RM for the following exercises on the Universal® gym: bench press, shoulder press, lat-pulldown, arm curl, leg press, and knee extension. One repetition maximum was determined by increasing the loads by single weight plate increments starting from a designated weight value for each exercise. The time allowed between successive trials was that required to readjust the pin which supported the weights (5-10 secs).

Power: Power (the maximal amount of work produced per unit of time) was determined with a Monark arm ergometer. Subjects were instructed to crank the handles as rapidly as possible for a 30 s period of time at a resistance setting of 100 W. The number of revolutions performed was then recorded.

Muscular Endurance: Muscular endurance (the ability of a muscle or group of muscles to sustain submaximal contractions) was assessed by determining the number of repetitions subjects could perform at 60% of their 1RM for that exercise. Muscular endurance of the upper and lower torso were measured with bench and leg press exercises respectively. Muscular endurance of the trunk was estimated from the maximal number of bent knee sit-ups an individual could perform within a period of two minutes.

Stamina: Stamina (a combination of aerobic fitness and muscular endurance) was assessed as maximal work capacity on a Monark bicycle ergometer based on a protocol developed by a NATO research study group (Myles and Toft, 1982). Subjects were

instructed to pedal at a constant rate of 76 rev min $^{-1}$ against a progressively increasing resistance until volitional fatigue. Warm-up lasted for a period of three minutes at a workload of 37 W. Thereafter, the workload was increased every minute by 37 W. The greatest workload that the participant could maintain for 50 s was recorded as the measure of physical work capacity.

Body Composition: This component of fitness is defined as the relative amount of the total body weight made up of muscle, bone, and fat. During this investigation each subject was measured for standing height (cm) and body weight (kg). To assess relative body composition, two circumferences (neck, abdomen) were measured with a fiberglass tape by a single trained tester. A mean of two assessments for each circumference site was accepted as the representative value for that site. Percentage body fat was estimated using an equation developed by Hodgdon and Beckett (1984) for Navy men utilizing neck and abdomen circumferences and height.

Shipboard Tasks: This assessment was carried out onboard the USS Recruit a training vessel located at the Naval Training Center, San Diego, CA. This provided us the opportunity to simulate realistic shipboard tasks in a controlled environment Tasks were chosen for evaluation based on the following rationale: 1) Criterion tasks represented general shipboard evolutions; i.e., chores that all personnel could be called upon to perform at any time. 2) Modelled tasks involved basic body efforts, (e.g., lift/carry, carry/walking, pushing, pulling) integral in shipboard work. 3) Similar tasks had previously been administered to a sample of Navy personnel and had been deemed safe, valid and feasible simulations of shipboard work (Robertson, 1983). A description of task scenarios and scoring procedures follows.

Open/Secure Multi-dogged Water Tight Door - Participants were required to first open and then secure the fittings of an 8-dogged water tight door following a prescribed sequence commonly utilized in the fleet. Time (s) required to perform the scenario was recorded.

Paint Bucket Carry - Participants were required to carry a 22.7 kg paint bucket a distance of 45.7 M which included climbing up and down an inclined ladder. Time (s) required to perform the scenario was recorded.

Extricate Injured Personnel Via Shoulder Drag Technique - Participants were required to shoulder drag a 75.4 kg manikin a distance of 12.8 M and over the lip of a water tight door. Time (s) required to perform the event test was recorded.

Composite Shipboard Performance - To calculate overall ability to execute the assorted lifting, carrying, and pulling efforts commensurate with shipboard work,

composite task performance was also determined. This was derived from the summed time (s) required to complete the three individual tasks.

ANALYSIS PROCEDURES

Differences in fitness and shipboard performance changes between physical training programs were assessed by analysis of covariance (Tatsuoka, 1971). The analysis was performed using the "Statistical Package for the Social Sciences" (Hull and Nie, 1981), with the initial values of the individual fitness measures as covariates. "Adjusted values" (Walker and Lev, 1953) of fitness measures are reported to remove differences in pre-training fitness measures between groups. Within-group pre-post training differences in fitness and shipboard performance were assessed using the t-test for correlated means (Linton and Gallo, 1975). Statistical significance was set at $p \leq 0.05$.

Multiple regression techniques were employeed to develop regression equations for predicting criterion task performance from parameters of fitness (pre-test training values used). Variables entered the equation in a forward stepwise fashion. Variables were added to the equation until the resultant change in the square of the correlation coefficient was less than 0.01 (1% of the accounted for variance). The following fitness variables were selected to represent upper and lower torso muscular strength and muscular endurance.

- upper torso muscular strength (bench press and arm curl, 1RM)
- lower torso muscular strength (leg press, 1RM)
- upper torso muscular endurance (bench press, 60% 1RM)
- lower torso muscular endurance (leg press, 60% 1RM)

Muscular strength and endurance were measured on the same exercise (i.e., bench press 1RM, bench press 60% 1RM) for purposes of consistency. The arm curl test was selected for prediction purposes because it measures predominantly the strength of the biceps brachialis muscle. According to Robertson (1982) this muscle is utilized during a wide assortment of Navy shipboard chores, particularly tasks requiring lifting and carrying of heavy materials.

RESULTS

Within and between group changes in fitness and criterion task performance are listed in Figs. 1-4. The results of the study can be summarized as follows: 1) Significant ($p \leq 0.05$) gains were observed in both groups for all fitness variables

except knee extension and bench press muscular endurance; 2) Signifcantly ($p \leq 0.05$) higher values for the shoulder press (F = 7.2) arm ergometer (F=5.3) and sit-up (F = 6.8) but lower values for leg press muscular endurance (F = 5.1) were observed in CWT/IR when compared to CWT/CR; and 3) Both training groups showed significant ($p \leq 0.05$) relative improvement in only manikin shoulder drag performance.

Table 2 presents the results of the regression analysis. Individual and composite shipboard task performance was best predicted by the following equations.

Open/Secure Water Tight Door (s)
= No significant predictors

Paint Bucket Carry Performance (s)
= 96.09019 - .12483 (leg press)
- .68142 (arm curl) r = 0.72

Manikin Drag Performance (s)
= 48.91583 - .45769 (arm curl)
- .07396 (leg press) r = 0.56

Composite Task Performance (s)
= 194.15097 - 1.59492 (arm curl)
- .18369 (leg press) r = 0.74

DISCUSSION

Participation in the different running regimes was found to be associated with differential changes in several parameters of muscular strength and muscular endurance but not stamina. Interval training subjects showed superior gains in shoulder press and sit-up performance while continuous training participants experienced greater relative gains in leg muscular endurance. The basis for these training outcomes is difficult to interpret. Evidence supplied by Hickson (1980) may help to explain these findings. This investigation compared strength, endurance, and combined strength and endurance (interval and continuous training) exercise programs. It was found that strength conditioning enhanced only muscular strength and endurance training only aerobic capacity. Interestingly, simultaneous strength and endurance training reduced capacity to develop strength but not aerobic fitness. This evidence suggest that musuclar adaptations to strength and endurance exercise are highly specific. Findings of the present study may further be interpreted to mean that the particular type of endurance training (interval versus continuous) may elicit highly selective skeletal muscle adaptations.

While fitness changes in response to training mode varied somewhat between the exercise group, no discernible difference in shipboard performance was observed. Furthermore, fitness gains accrued during both training formats were not totally translated into improved work performance. Of the three shipboard tasks administered pre- and post-training only the manikin drag evolution was significantly altered by training. Changes in manikin drag performance seem to be associated with improvement in overall upper torso muscular strength on part of the participants from both groups. Improved manikin drag performance, however, may not have been solely fitness dependent. Methodological factors may have affected final outcomes. For instance, skill acquired during pre-test administration may have contributed to enhanced post-test performance. To reduce a "learning effect" each recruit was allowed a single practice trial prior to the pre-test administration. The ability to manuever the manikin through the WTD, however, may have been a multiple trial learning task.

Water tight door and paint bucket carry events were unaltered by training. These findings suggest the critical requirements for these tasks may have been components of fitness not conditioned by the exercise regimes. Conceivably, coordination and speed of movement may have been important motor factors during in the water tight door scenario. Balance and agility may have influenced ladder climbing performance during the paint bucket carry task.

Results of the regression analyses support several of the preceeding findings. Water tight door performance, for instance, was not significantly related with any single measure of fitness. The implication here is that physical abilities other than those improved by training were critical to task performance. This task was chosen for simulation because water tight doors are common shipboard fixtures, and depending on frequency of use and maintenance, may present formidable muscular demands. The average force requirement needed to open/secure locking mechanisms during this study was approximately 18.2 kg. Forces of this magnitude do not reflect "worst case" situations found onboard ship, and apparently are not sufficient to warrant significant muscular strength demands.

The manikin shoulder drag represented an emergency procedure where brute strength (i.e., lifting and dragging a 75.4 kg manikin) and speed were critical task elements. Arm curl and leg press measures were found to best predict performance. The following factors may help to explain this finding: 1) This extrication procedure placed considerable stress on upper torso musculature, particularly the biceps brachialis muscle. The arm curl fitness measure involves a maximal lift which primarily involves

this muscle. Utilization of similar musculature during the performance test (manikin drag) and fitness measure (arm curl) resulted in a significant correlation ($p \leq 0.05$) between the two variables ($r = 0.51$). 2) Addition of the leg press measure improved task prediction to ($r = 0.56$). Involvement of leg musculature during the lifting phase of this event probably accounted for the improved prediction power.

The paint bucket carry represented a commonly performed shipboard chore with seemingly moderate muscular demands. Composite leg press and arm curl scores accounted for over 50% of the variance in task performance ($r = 0.72$). Both tests seem logical task predictors considering the hand, arm, and shoulder girdle strength required to carry the paint bucket (22.7 kg) and leg strength needed to climb the inclined ladder.

Individual task performance tests were summed to provide an indication of overall performance. Again arm curl and leg press tests were the best determinants of shipboard work ($r = 0.74$). It is worthy to note here that neither tests of upper or lower torso muscular endurance (i.e., bench press 60% 1RM, leg press 60% 1RM) demonstrated significant predictive ability. Brief execution time of the particular tasks modelled may possibly account for this finding. For example, mean task duration ranged from 21.8 sec $\pm$ 8.1 for the manikin drag task to 53.4 sec $\pm$ 10.0 for the bucket carry scenario.

CONCLUSION

In conclusion, this investigation found both CWT/IR and CWT/CR programs promote overall fitness although relative muscle strength, power, and muscle endurance gains may be somewhat varied. Furthermore, the association between training induced fitness gains and improved job performance appeared to be specific to the task modelled. While the need for upper torso strength during Navy jobs has been previously noted, findings of the present investigation underscore the need for lower torso muscular strength as well. Results reported here have important implications to the Navy since the present battery of tests (OPNAVINST 6110.1B) used to physically evaluate personnel contains no measure of muscular strength. Although the present study did find valid muscular determinants of shipboard work, the utility of these measures in a field setting is uncertain. Further research needs to be directed towards developing a field applicable strength measure.

REFERENCES

Gettman, L.R., Ayres J.J., and Pollock, M.L. The effect of circuit weight training on strength, cardiorespiratory function and body compostion of adult men. Med. Sci. Sports. 10:47, Fall, 1978.

Hickson, R.C., Interference of Strength Development by Simultaneously Training for Strength and Endurance. Eur. J. Appl. Physiol. 45, 255-263, 1980.

Hodgdon, J.A., and Beckett, M.B. Prediction of percent fat for U.S. Navy men from body circumference and height. NHRC Report No. 84-11. 1984.

Hull, C.H. and Nie, N.H. Statistical Package for the Social Sciences (SPSS) Update 7-9. San Francisco: McGraw Hill Book Co., 1981.

Linton, M. and Gallo, P.S., Jr. The Practical Statistician: Simplified Handbook of Statistics. Monterey, CA: Brooks/Cole Publishing Co., 1975.

Myles, W.S. and Toft, R.J. An evaluation of a test of maximal physical working capacity. Summaries of the 3rd RSG4 Physical Fitness Meeting, Mainz, Germany, September 1980.

OPNAVINST 6110.1B of 19 October 1982, Subj: Health and Physical Readiness Program.

Robertson, D. Development of an occupational strength test battery (STB). Navy Personnel Research and Development Center TR-82-42, April, 1982.

Robertson, D. Relationship of dynamic strength, static strength, and body weight to mental and muscular tasks. Proceedings of the 24th DRG Seminar on the Human as a Limiting Element in Military Systems. Toronto, Canada, 2-4 May 1983.

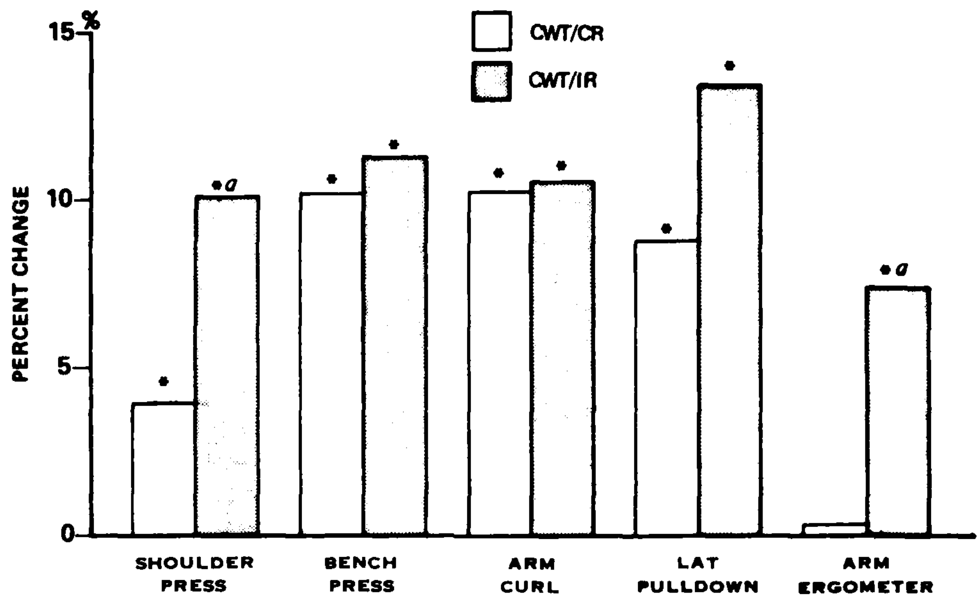
Tatsuoka, M.M. Multivariate Analysis. New York: Wiley, 1971.

Walker, H.M. and Lev, J. Statistical Inference. New York: Holt, Rinehart, and Winston, 1953.

Wilmore, J.H. Quantification of Endurance Training Programs. Exercise and Sports Science Review. P 181, Vol. 1, 1973.

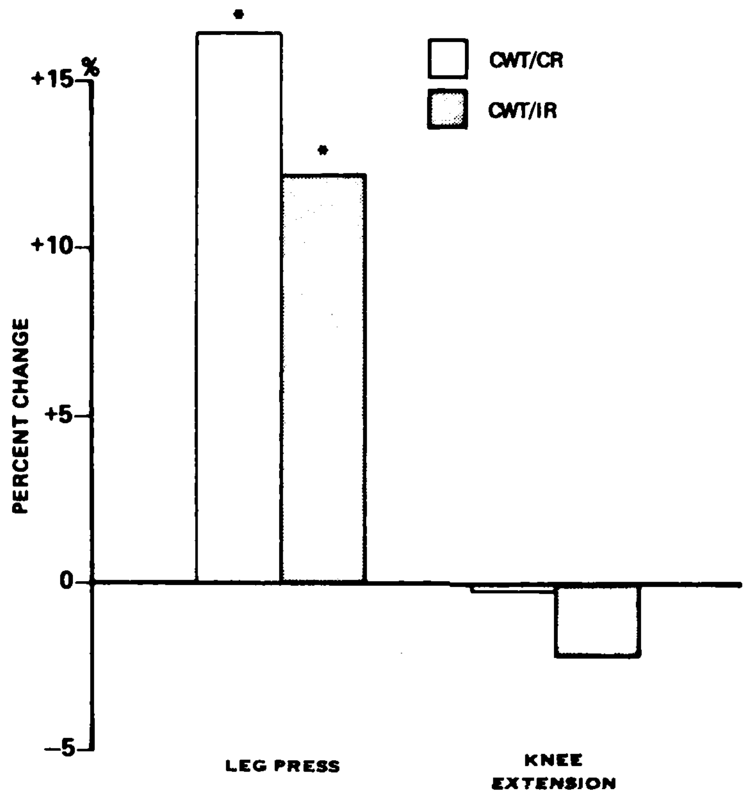
Wilmore, J.H., Parr, R.B., and Girandola, R.N. Physiological alterations consequent to circuit weight training. Med. Sci. Sports . 10:79-84. Summer, 1978.

U.S. Department of Health and Human Services. Work Practices Guide for Manual Lifting. National Institute for Occupational Safety and Health. Technical Report, March, 1981.



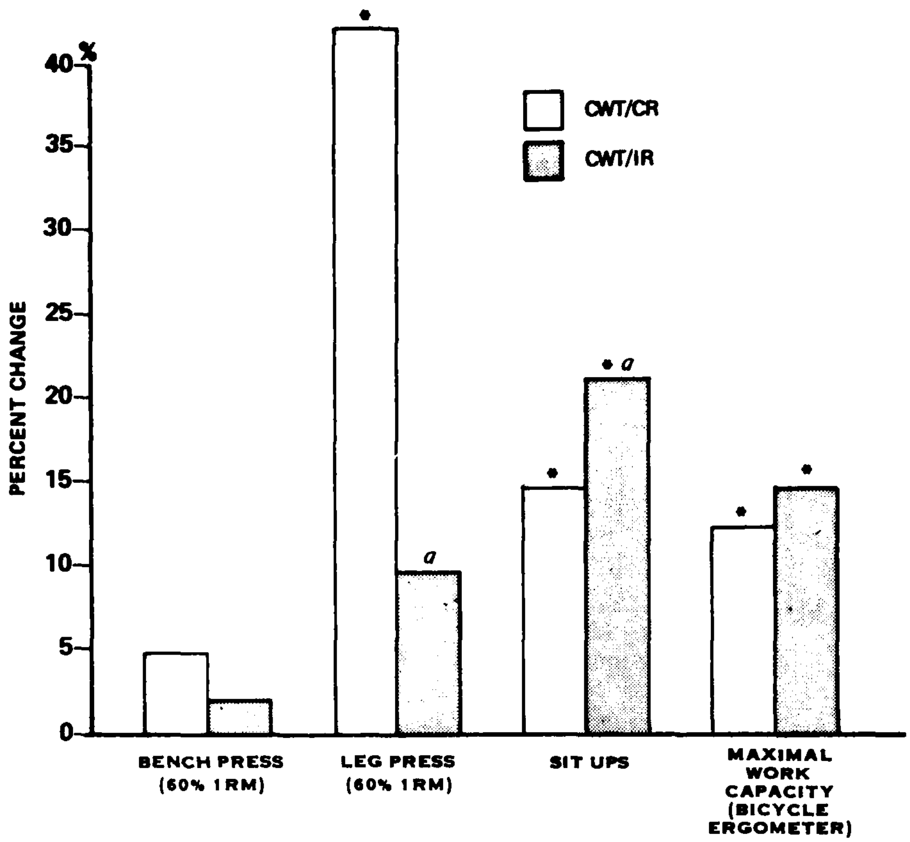
**Significantly different from initial mean value ($p \leq 0.05$)*
[a] Significantly different from CWT/CR ($p \leq 0.05$)

Figure 1. Upper torso dynamic strength and power changes following the 8-week training period



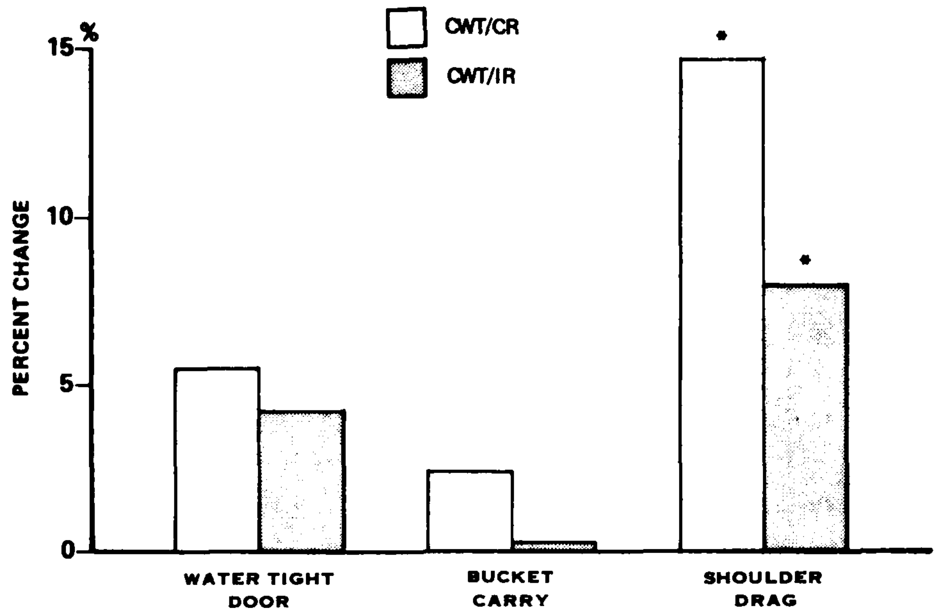
*Significantly different from initial mean value ($p < 0.05$)
[a]Significantly different from CWT/CR ($p < 0.05$)

Figure 2. Lower torso muscular strength changes following the 8-week training period



**Significantly different from initial mean value ($p < 0.05$)*
[a]Significantly different from CWT/CR ($p < 0.05$)

Figure 3. Muscular endurance and stamina changes following the 8-week training period



**Significantly different from initial mean value ($p < 0.05$)*
[a]Significantly different from CWT/CR ($p < 0.05$)

Figure 4. Shipboard task performance changes following the 8-week training period

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This investigation compared fitness and work performance changes following participation in circuit weight training regimes featuring either interval or continuous running programs. Results indicated that participation in the circuit weight training/run regimes was associated with differential changes in fitness but not shipboard work performance. Furthermore, the association between training induced fitness gains and relative improvement in job performance appeared to be specific to the task modelled. Important predictors of criterion job performance included measures of both upper and lower torso

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muscular strength. Regression analyses yielded the following prediction equation: Composite shipboard performance(s) = 194.15097-1.59492 (arm curl) -.18369 (leg press) r=0.74. Keywords: psychological data; Naval personnel.

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